

Carbon isotope stratigraphy of C40-alkenone and its significance: Cretaceous OAE2 horizon, IODP Site U1516

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Alkenone (strait chain alkyl ketone) molecules from marine sediments are known to be products of haptophyte algae and are often employed for paleothermometry for Quaternary and Neogene. Di- and Tri-unsaturated alkenones with 37 carbon atoms (C37 alkenones) are the target molecules for this purpose. On the other hand, only di-unsaturated one has been reported from Paleocene or Cretaceous. Thus alkenone paleothermometry cannot be applied as same way for these greenhouse periods although di-unsaturated alkenone molecules with 37-41 carbon atoms have been reported.

This study detected alkenones with 37-40 carbon atoms in the late Cretaceous sediments from southern margin of proto-Indian Ocean (IODP Exp. 369 Site U1516). Di-unsaturated C40 alkenone (C_{40:2}Et) was the most dominant species among the alkenones. In addition to C_{40:2}Et, tri-unsaturated C40 alkenone (C_{40:3}Et) was observed by this study for the first time.

Stratigraphic fluctuation of C_{40:2}Et content showed conspicuous high value at the top of black clay layer (BCL: sediment associated with OAE2). It is relatively low through the interval below BCL. It decreased above BCL and reach to substantially zero at 30 cm above top of BCL, then no detection above. This is concordant with the fluctuation of TOC.

Carbon isotope values of C_{40:2}Et were obtained from 12 horizons. Upper nine samples are from the interval without $\delta^{13}\text{C}$ curve because of low carbonate content. Our $\delta^{13}\text{C}$ data of C_{40:2}Et filled the part of the gap and give clue to the international correlation of OAE2 interval based on $\delta^{13}\text{C}$ stratigraphy. The $\delta^{13}\text{C}$ value showed gradual increase through the lower part with minor fluctuation, then dramatic increase through the BCL, and recorded its maximum value ($\sim -29\text{‰}$) near the top of BCL. Modest drop to -30‰ was observable within the interval 20 cm above the BCL whereas $\delta^{13}\text{C}$ value could not be obtained through the interval above as the abundance of C_{40:2}Et was too low. Total magnitude of the excursion at the top of BCL reached as large as 4‰ . It could be correlated to a peak that comprises well known carbon isotope excursion of OAE2. If this interpretation is correct, then accumulation of organic matter was limited in the early stage of OAE2 and was interpreted to be as multiple short-lived events. Further collaborative researches are required with chronostratigraphers for age calibration.

Keywords: carbon isotope, alkenones, Cretaceous